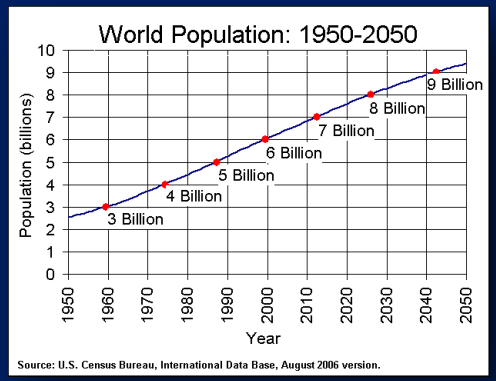
Short-rotation Willow Productivity and Nutrient Dynamics After Three Years of Irrigation and Fertilization

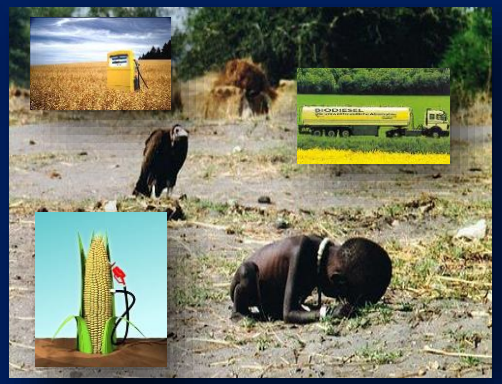
R.D. Hangs, J.J. Schoenau, and K.C.J. Van Rees

SASKATCHEWAN CENTRE FOR SOIL RESEARCH

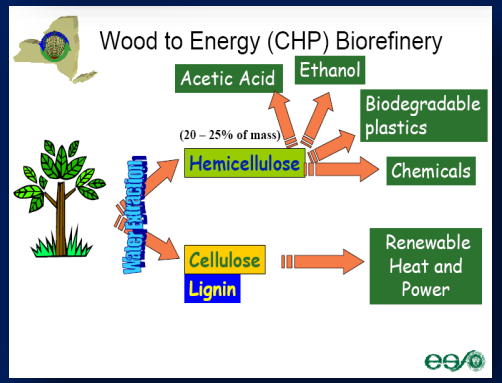
Why Willow: Triple Bottom Line

Social





Economic



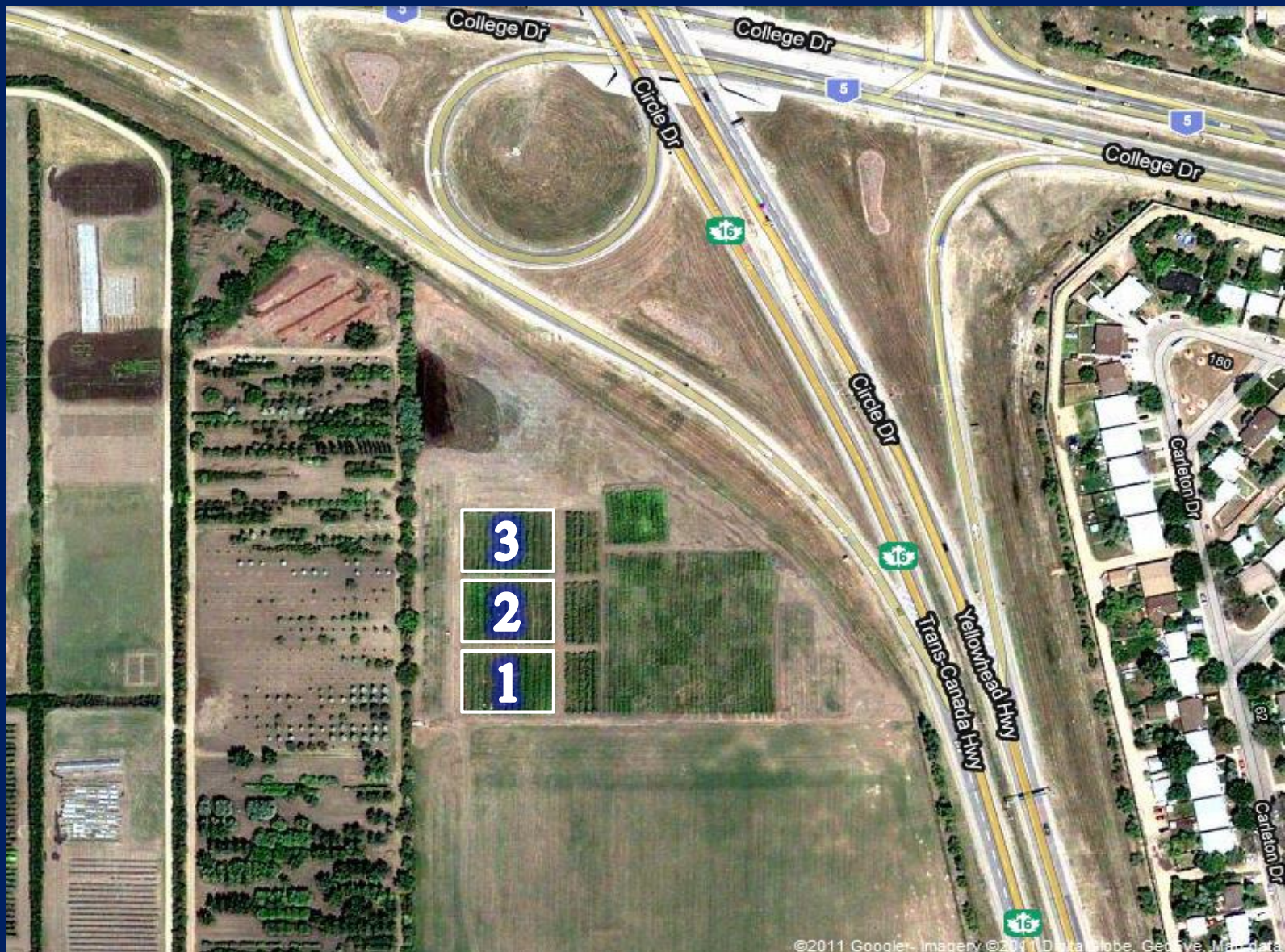
Environment

Objective

Determine the effects of irrigation and fertilization on willow biomass feedstock quantity and quality.

This presentation:
Willow productivity after three years
and
Fertilizer nitrogen dynamics

Study Site


College Dr
College Dr
College Dr
Circle Dr
Circle Dr
Yellowhead Hwy
Trans-Canada Hwy
Carleton Dr
Carleton Dr
3
2
1
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Study Site

Past management: barley/oats

Growing season precipitation:

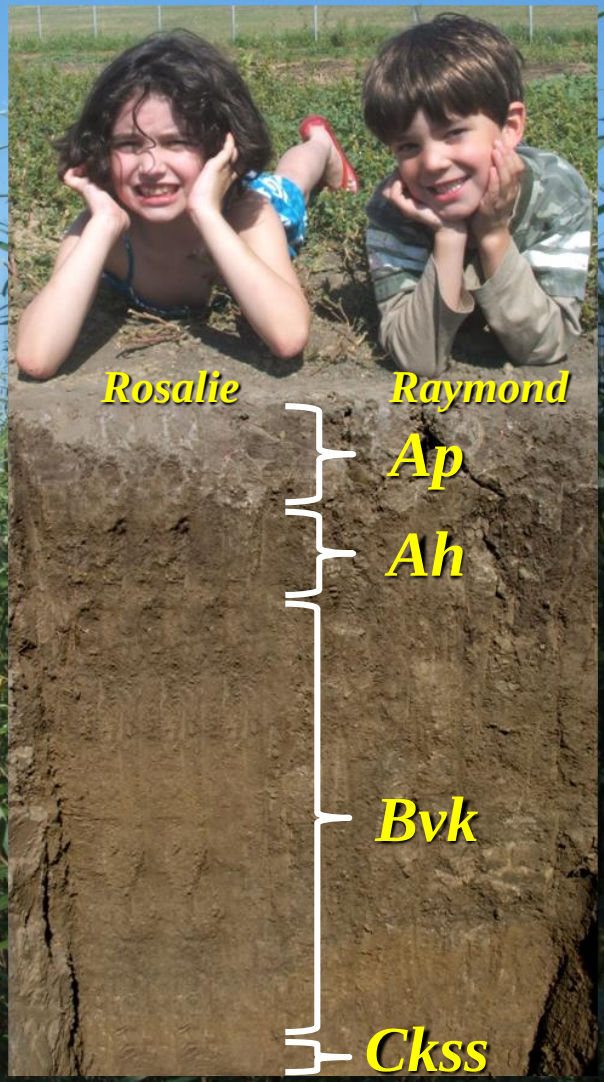
2008 (165 mm)

2009 (201 mm)

2010 (467 mm)

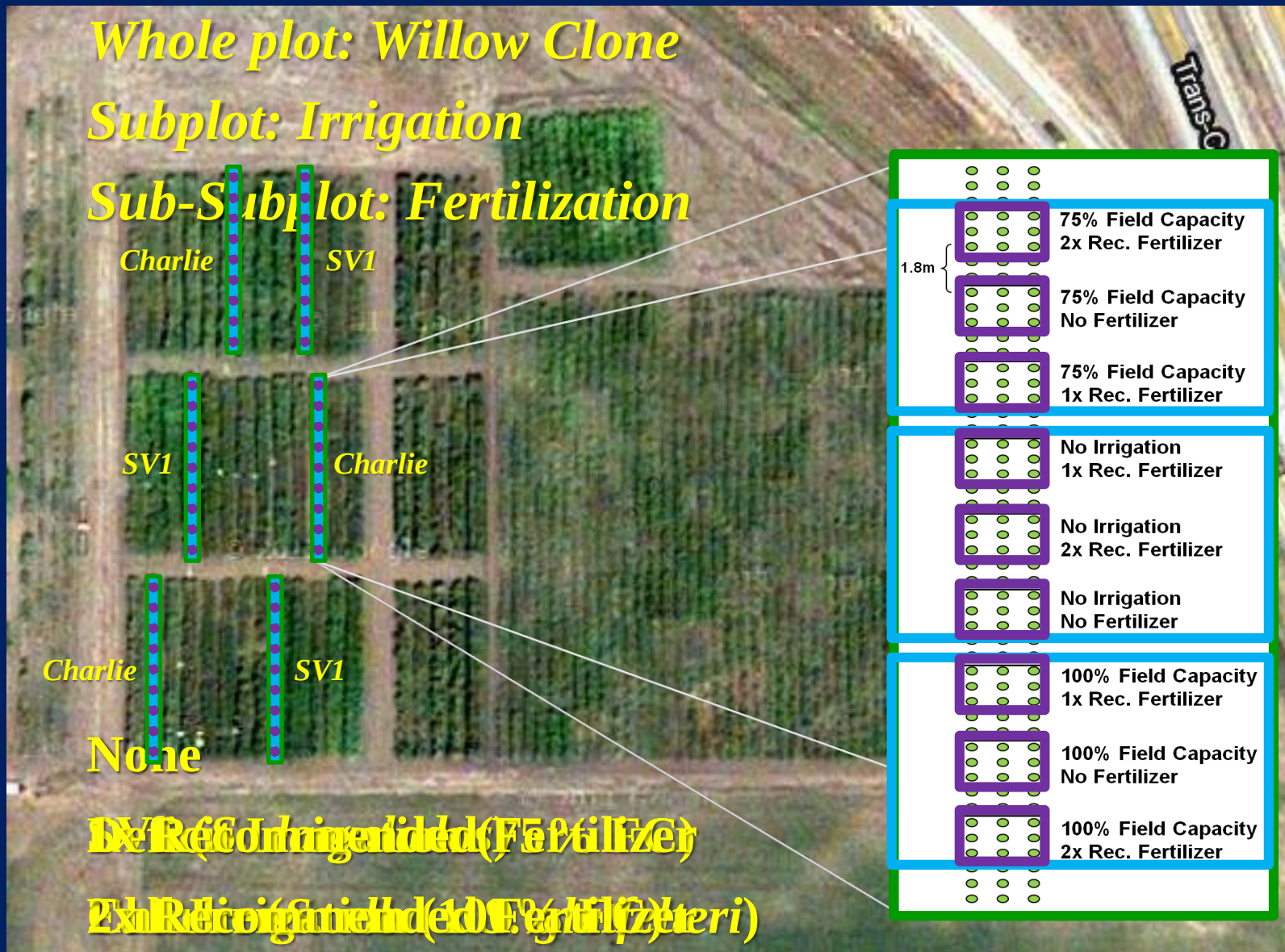
Soil: Orthic Vertisol
Sutherland Association
Glacial lacustrine PM

Agriculture Capability Classification Rating: Class 2



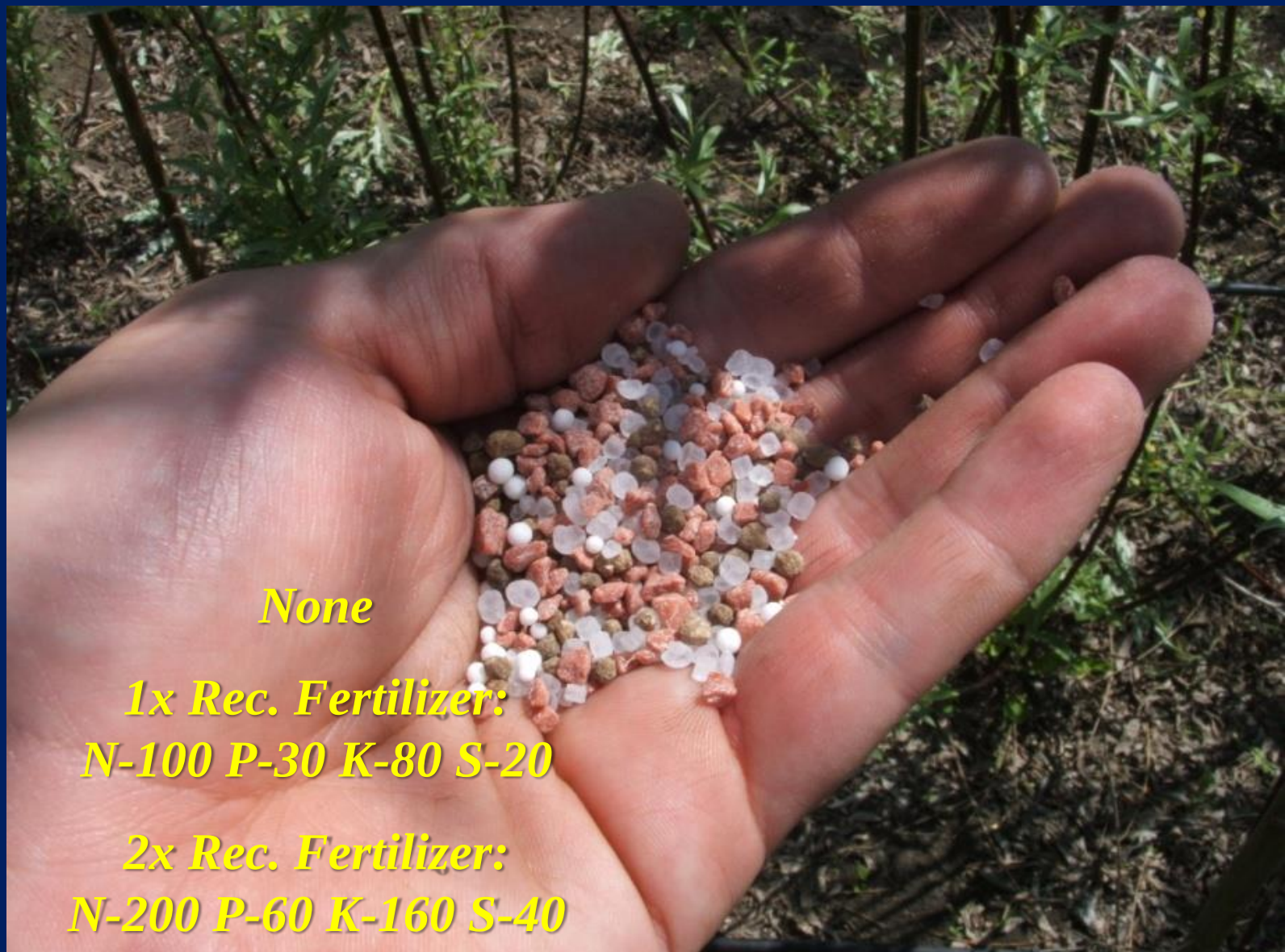
Experimental Design

(Split-Split-Plot)



Controlling Irrigation Rates

Fertilization Rates (kg/ha)

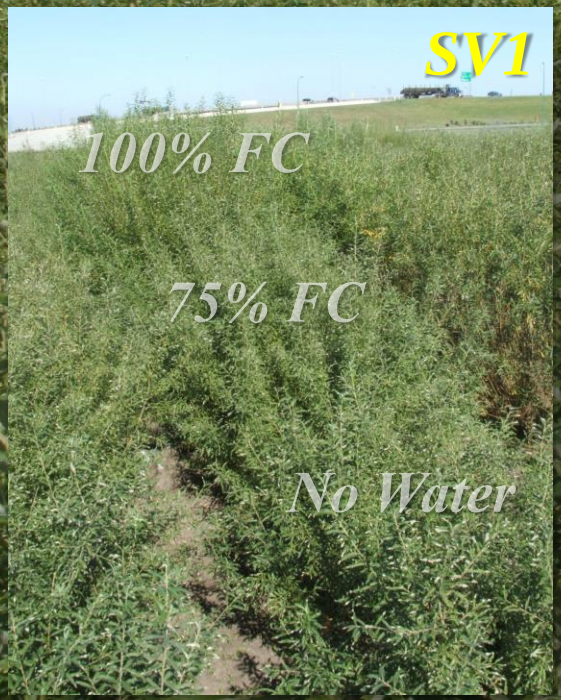


None

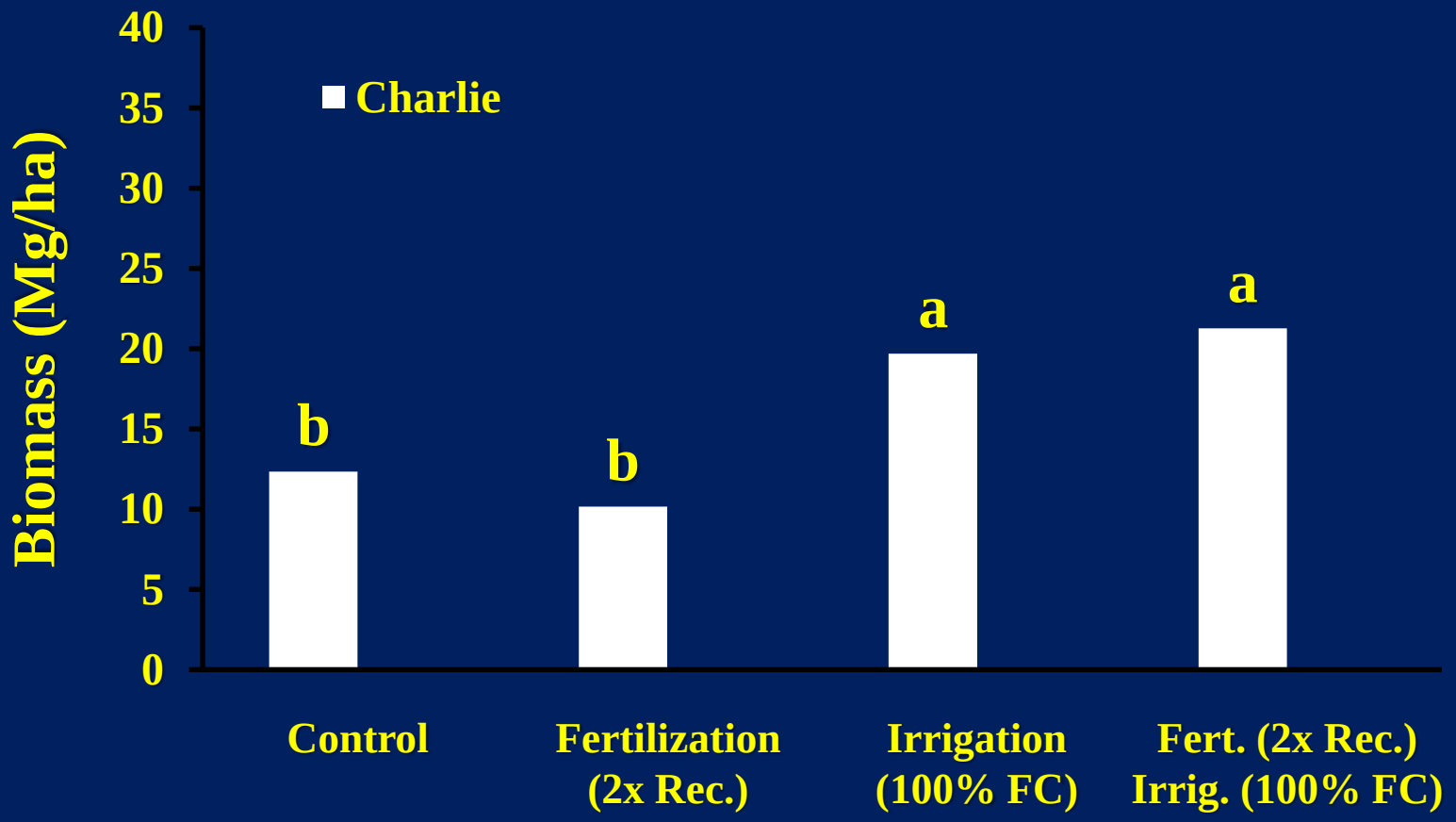
1x Rec. Fertilizer:
N-100 P-30 K-80 S-20

2x Rec. Fertilizer:
N-200 P-60 K-160 S-40

Results and Discussion:
Willow Biomass Production



*Mean (n = 3) effect of irrigation and fertilization on above-ground biomass production of the willow clones 'Charlie' and 'SV1' after three growing seasons**



**For each clone, bars with the same letters are not significantly different (P >0.05) using LSD.*

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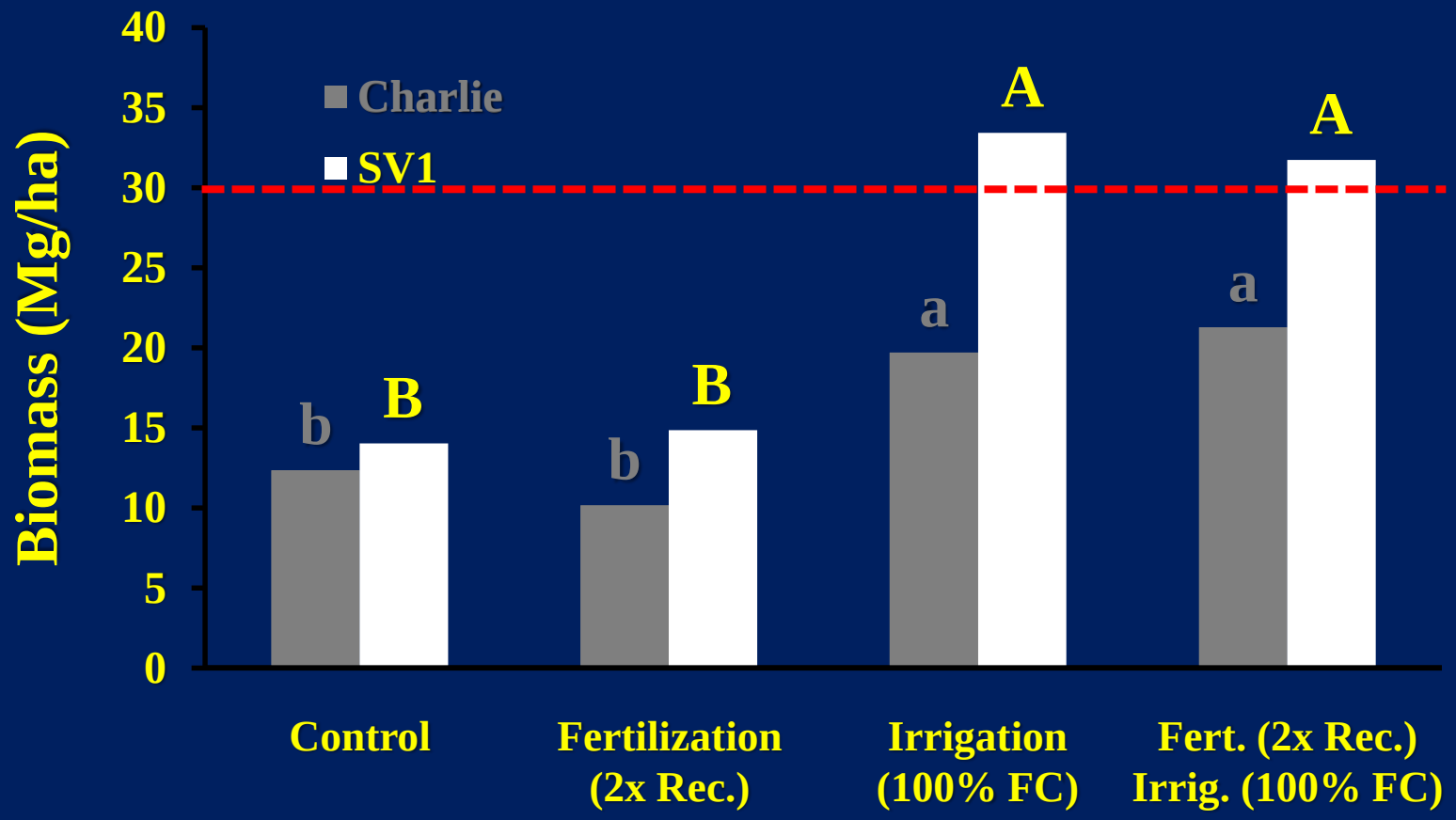

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Where Does The Fertilizer Go?!?

Competing Vegetation

Leaves (September)

Leaves (November)

LFH

Fine and Coarse Roots

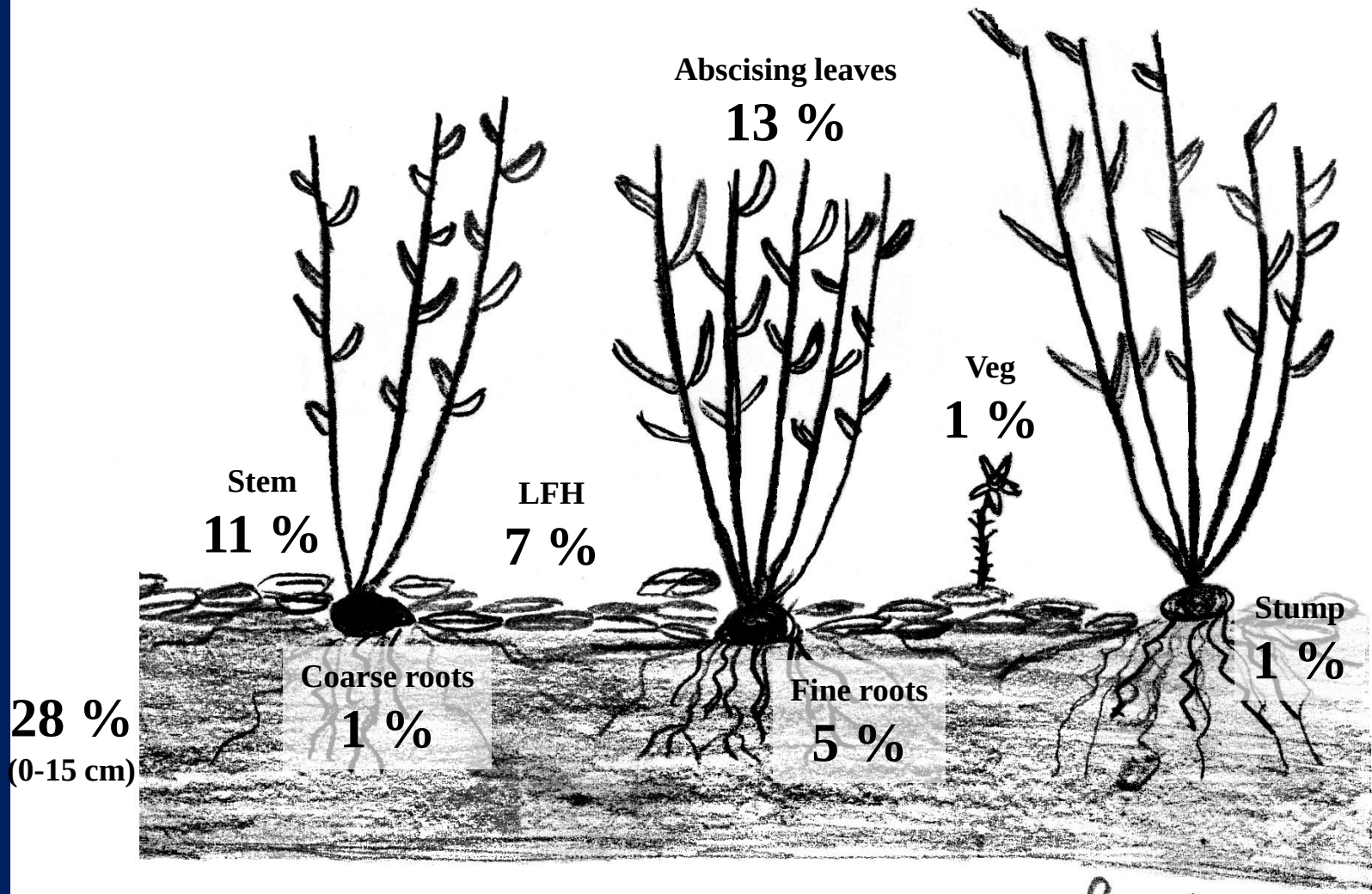
Stems

Stool

Soil

0-15, 15-30, 30-45, and 45-60 cm increments

Fate of Applied Fertilizer N

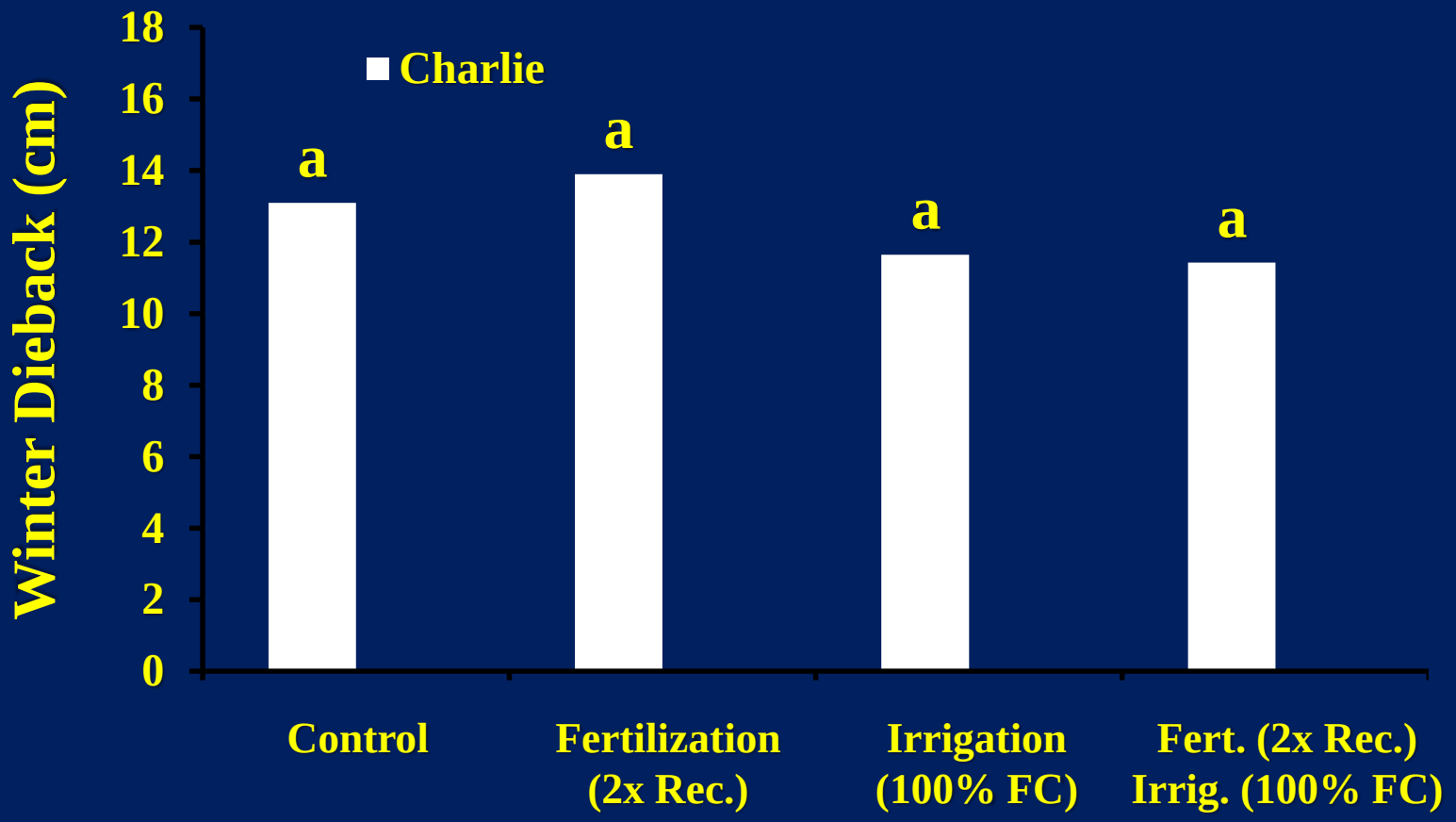


Overall ^{15}N Recovery: 67 %

Cold Hardiness

October 10, 2009

*Mean (n = 3) effect of irrigation and fertilization on the cold hardiness of willow clones 'Charlie' and 'SV1' after the first two winters**



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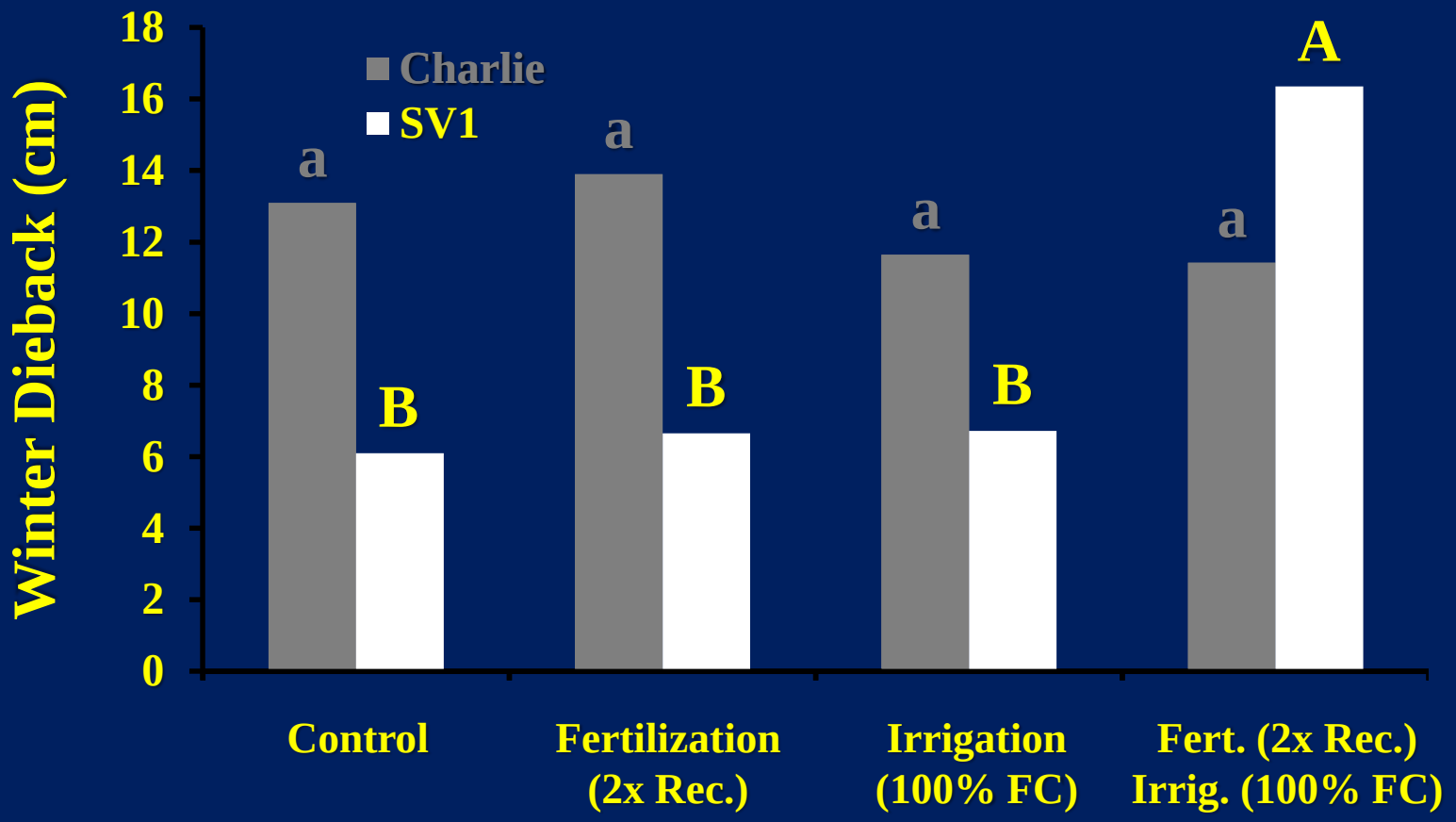

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Conclusions

- *After three growing seasons, there was a highly significant (P <0.0001) growth response to irrigation. Highlights the importance of water in the semi-arid climate of Saskatchewan.*
- *No significant (P >0.05) fertilization or fert x irrig effects (due to existing high nutrient supply rates of soil and/or low nutrient requirement of willow?).*
- *10 Mg/ha/yr yield is possible when irrigating high-yielding willow varieties on fertile soils.*
- *Future work: wood quality assessments; nutrient and water budgets.*

Many Thanks!!!!!!

NSERC CRSNG

Government of Saskatchewan

CFS CANADIAN FOREST SERVICE

Many Thanks!!!!!!

Stable Isotope Facilities

Many Thanks!!!!!!


Questions?